WATER QUALITY ISSUES FACING AGRICULTURE AND RURAL COMMUNITIES

Tony Prato
Professor of Resource Economics and Management
University of Missouri-Columbia

Outline

- Progress and Challenges in Water Quality
- New Production Technologies
- Policy
- Information Technologies and Rural Communities
- Future Prospects

Progress and Challenges in Water Quality

- Clean Water Act of 1972
- National Pollution Discharge Elimination System (NPDES) – emission permits
- 1998 National WQ Inventory indicates that 40% of assessed U.S. streams, lakes and estuaries were not clean enough to support uses such as fishing and swimming.
- 291,000 miles of assessed rivers and streams (35%), 7.9 m acres of lakes (45%) and 12 thousand sq mi of estuaries (44%).

Nature and Sources of Water Pollution

- Sediment and nutrients are the most common pollutants.
- Nonpoint sources include runoff from farms, pastures, urban areas, and timber harvesting and mining operations.
- Agriculture leading source of pollution
  - 60% of impaired river miles
  - 50% of impaired lake acreage

Accomplishments

- From 1977 to 1992, sediment delivery from cropland to water bodies decreased by about 740 million tons, or 38 percent.
- The goal over the next five years is to achieve an additional 25 percent reduction in soil erosion on cropland.

Conservation Practices

- Reduced and no tillage
- Terraces
- Contour farming
- More efficient and timely application of nutrients and pesticides
- Others

Setbacks

- *Pfiesteria*: Lagoons in North Carolina overflowed because they were not designed to handle the intensity of storm events that occurred in the region.

- CAFOs: In Missouri and other states, animal waste disposal equipment failures have resulted in numerous fish kills.

- Hypoxia: Nutrient loads to the Mississippi River from agricultural, urban and other sources are causing ecological degradation in the Gulf of Mexico.

New Production Technologies

- New and emerging production technologies have the potential to further reduce adverse water quality impacts of agricultural production.

- Site-specific farming can increase farm profitability (by increasing yields and/or reducing input costs) and/or reduce nonpoint source water pollution.

- GMOs have allowed development of new plant varieties that are resistant to certain herbicides and pests.

- Pest resistance reduces the use of pesticides, which can generate significant water quality benefits particularly in areas where soil and weather conditions increase the risk of pesticide contamination.

- Drought tolerant plants can reduce dependence on irrigation and groundwater pumping costs.

- Drought resistance is a benefit in arid areas of the country experiencing rapid urbanization and/or greater weather variability due to climate change.

- On the other hand, there are many ethical issues and social and environmental risks associated with GMOs that must be assessed.

Policy

- Federal and state agricultural policies have stimulated the adoption of conservation technologies and cropping systems that increase soil and water conservation.

- Conservation compliance: Eliminated inconsistencies between commodity and soil conservation programs

- Conservation Reserve Program: Idled millions of acres of highly erodible cropland, thereby reducing nutrient/pesticide application and runoff.

- Wetland Reserve Program: Stimulated conversion of cropland to wetland. Wetlands sequester sediment, nutrients and pesticides.

Regulatory Approach

- A regulatory approach has been used to control point sources, e.g., NPDES permits.
- Total Maximum Daily Load (TMDL) requirement of the Clean Water Act is a regulatory approach for controlling all sources of water pollution in a watershed.

Incentive-based Approach

- Cost sharing of soil and water conservation practices, CRP and EQIP, have reduced agricultural nonpoint source pollution.

Tradable emission permits

- Require regulatory agency to set an upper limit on total emissions from all sources in a particular area.
- TEPs issued based on limit.
- Permits tradable among sources at a price determined by demand and supply for permits and other trading restrictions imposed by the agency.

- TEPs allow a point source to buy emission permits from a non-point source and vice versa.
- TEPs minimize the cost of achieving a desired reduction in total emissions.

Changes in Ag Policy

- Changes in agricultural policy are likely to alter cropping patterns and farming practices, and hence environmental quality.
- To what extent do changes in ag policy reduce nonpoint source pollution?

Evidence

- In previous farm bills, farmers had incentives to plant crops that maintained their eligibility for crop-specific payments and increase acreage of program crops like corn and wheat.

- Prior to 1996, farm bills encouraged continued planting of corn and wheat and discouraged planting of soybeans, which are not eligible for subsidies.

- CARD used county-level data for six Midwest states (MN, ND, SD, NB, IA and KS) to determine how the decoupling provisions of the 1996 FAIR Act affected crop acreage.

- Results showed that from 1995 to 1999:
  - most counties had significantly greater soybean acreage
  - westward movement in corn acreage, and
  - dramatic decreases in wheat acreage.
- Increase in soybean acreage is cause for concern because soybeans are a more erosive crop than corn or wheat.

- On the other hand, soybeans do not require nitrogen fertilizers and atrazine like corn and wheat, which reduces the likelihood of surface and ground water contamination from these sources.

- There are likely to be pluses and minuses in terms of water quality from greater deregulation of agriculture.

Information Technologies and Rural Communities

- Communities are becoming increasingly concerned about the adverse impacts of agriculturally related air and water pollution on quality of life and ecological integrity.

- Collaborative decision-making allows communities to identify and evaluate strategies for reducing air and water pollution.

- Rapid advancements in information technologies facilitate collaborative decision-making:
  - geographic information systems
  - global positioning systems
  - remote sensing
  - Internet-based decision-support systems

Decision Support Tool

- CARES has developed a decision support tool for Saline County, Missouri that allows the community to determine the proximity of existing animal feeding operations to residential areas, roads, public drinking water supplies, streams, and public facilities, as well as identify the most suitable areas for future animal feeding operations.

Saline County Study -- Home - Netscape

File Edit View Go Communicator Help

Bookmarks Location: http://saline.missouri.edu/

CARES UMC Phone & E-mail Outlook Web MRI Home Page CARES Intranet MetaCrawler WebCT Course Li RealPlayer

Saline County Study

Recommendation!

Mission Statement: Promote a rational, predictable and stable investment environment that identifies and protects key resources, personal rights and property rights through a process that involves and educates the citizens of Saline County.

Saline County L.I.F.E.
Spring 2000 Classes

Land Use Public Issue Forum Homepage
Now updated with preference rankings

Meetings — Meetings of steering and subcommittees

Contact List — Contact information on Study members

Committees — Specific information on each committee

Documents — Documents produced by the Study

Recommendation to the Saline County Commission Regarding Land Use and Future Development in Saline County from the Citizen Steering Committee of the Saline County Study

Saline County Study -- Home - Netscape

File Edit View Go Communicator Help

Bookmarks Location: http://saline.missouri.edu/

CARES UMC Phone & E-mail Outlook Web MRI Home Page CARES Intranet MetaCrawler WebCT Course Li RealPlayer

Documents

Documents produced by the Study

Recommendation to the Saline County Commission Regarding Land Use and Future Development in Saline County from the Citizen Steering Committee of the Saline County Study

Mapping Tools

Interactive mapping and decision support tool

Photo Gallery

Take a look at our Photo Gallery

Search

Search this web for specific words

Links

MoDOT I-70 Improvement Study

Special Link: OSEDA's Saline County Facts

The Steering Committee and Management Team members of the Saline County Study are encouraged to take ownership of this web site. The public is also encouraged to send any comments or additions (i.e., reports, updates on progress, interesting information related to this project, etc.) to Chris Fulcher or Chris Barnett (preferably by e-mail or on floppy disk).

OUTREACH & EXTENSION UNIVERSITY OF MISSOURI LINCOLN UNIVERSITY

CARES

CPAC

Social Sciences Unit University of Missouri

This web site is supported in part by the University of Missouri Outreach and Extension Outreach Development Fund.

This web site is hosted by CARES- University of Missouri - Columbia

This web site is maintained jointly by the Saline County Study Steering Committee and CARES

For problems or questions regarding this web contact the Saline County Steering Committee or Chris Fulcher (CARES).

Last updated: November 24, 2000

Map Tools Top Page - Netscape

File Edit View Go Communicator Help

Bookmarks Location: http://saline.missouri.edu/maptools.html

CARES UMC Phone & E-mail Outlook Web MRI Home Page CARES Intranet MetaCrawler WebCT Course Li RealPlayer

Thematic Mapping and Decision Support Tools

View GIS layers or select livestock production sites in Saline County through an interactive mapping session. Troubleshootir

Make Map

Reset

ArcView IMS powered interactive livestock site selection tool

► About GIS Layers

► County Summary Statistics

Geophysical Data

- [x] **Saline County Boundary**
- [ ] **Land Cover**

Animal Feeding Operations
(Click layer for more information)

- [ ] MDNR CAFOs
- [ ] Class I CAFOs
- [ ] Animal Feeding Operations
- [ ] Land Available (for nutrient application)
- [ ] Nitrogen Application (Lagoon/Surface Applied)
- [ ] Phosphorus Application (Lag/Surface Applied)
- [ ] Nitrogen Application (Pit/Injection Applied)
- [ ] Phosphorus Application (Pit/Surface Applied)

Base Maps

- [ ] Digital Photos - 1990 (DOQQs)
- [ ] Digital Photos - 1996 (DOQQs)
- [ ] 1:24,000 USGS Topo Maps
- [ ] 1:100,000 USGS Topo Maps
- [ ] 1:250,000 USGS Topo Maps

County Districts

- [ ] Public Land Survey Network

Demographic Data

General Population

- [ ] Total Persons by Block
- [ ] Persons/sq mi by Block
- [ ] Total Persons by Block Group
- [ ] Persons/sq mi by Block Group

Age

- [ ] Median Age
- [ ] Persons Age 0-19
- [ ] Persons Age 20-39
- [ ] Persons Age 40-64
- [ ] Persons Age Over 65
- [ ] % Age 0-19
- [ ] % Age 20-39
- [ ] % Age 40-64
- [ ] % Age Over 65

Education

- [ ] Education Level
- [ ] Elementary Education
- [ ] Some High School
- [ ] High School Diploma
- [ ] Some College
- [ ] Associates Degree
- [ ] College Degree
- [ ] Graduate/Professional

Housing Units

- [ ] Housing Units by Block
- [ ] Housing Units by Block Group
- [ ] Housing Units/sq mi by Block
- [ ] Housing Units/sq mi by Block Group

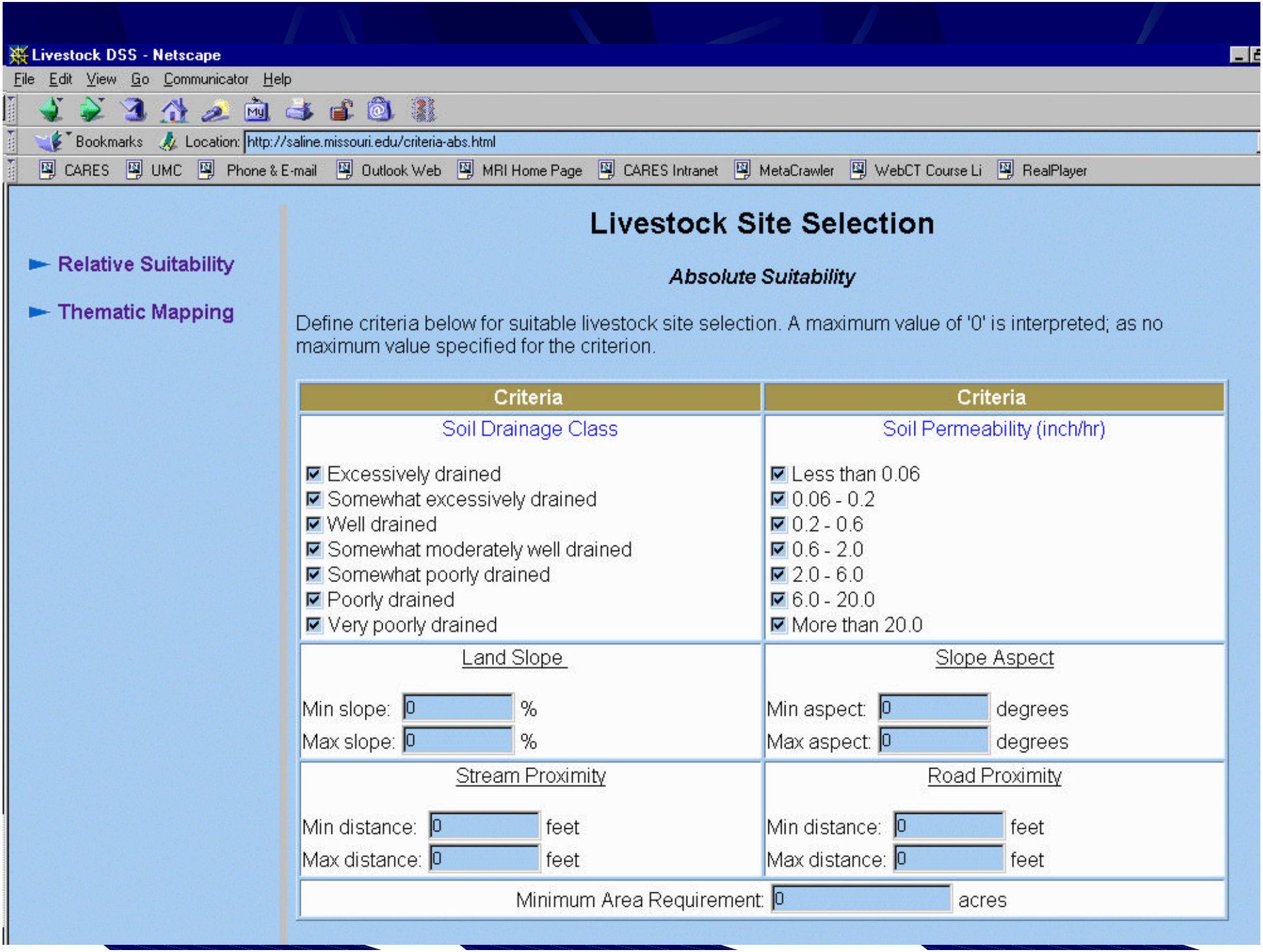
Income by Family

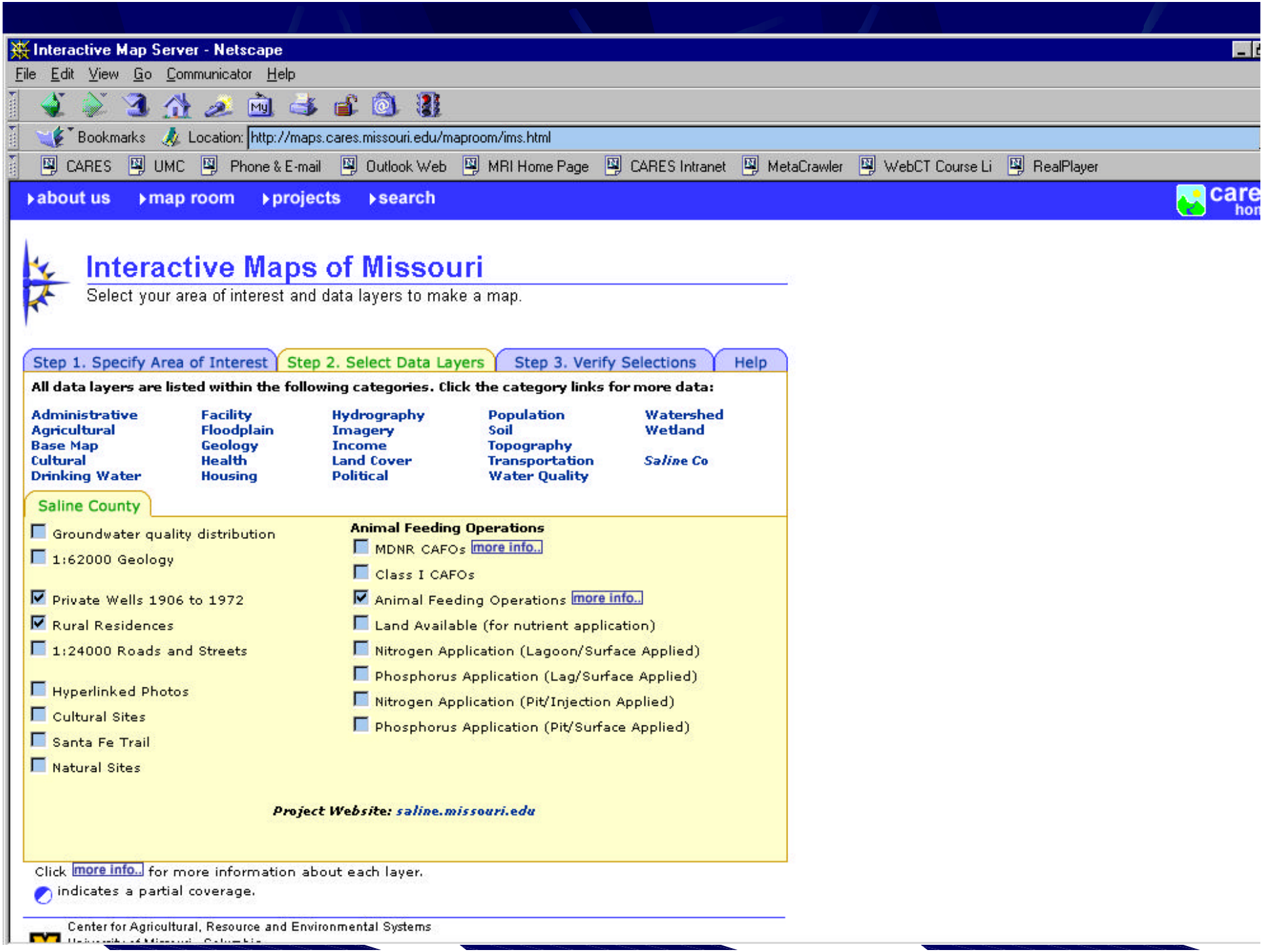
- [ ] Average Family Income
- [ ] Median Family Income
- [ ] Average Income No Workers
- [ ] Average Income 1 Worker
- [ ] Average Income 2 Workers
- [ ] Average Income 3 or more Workers

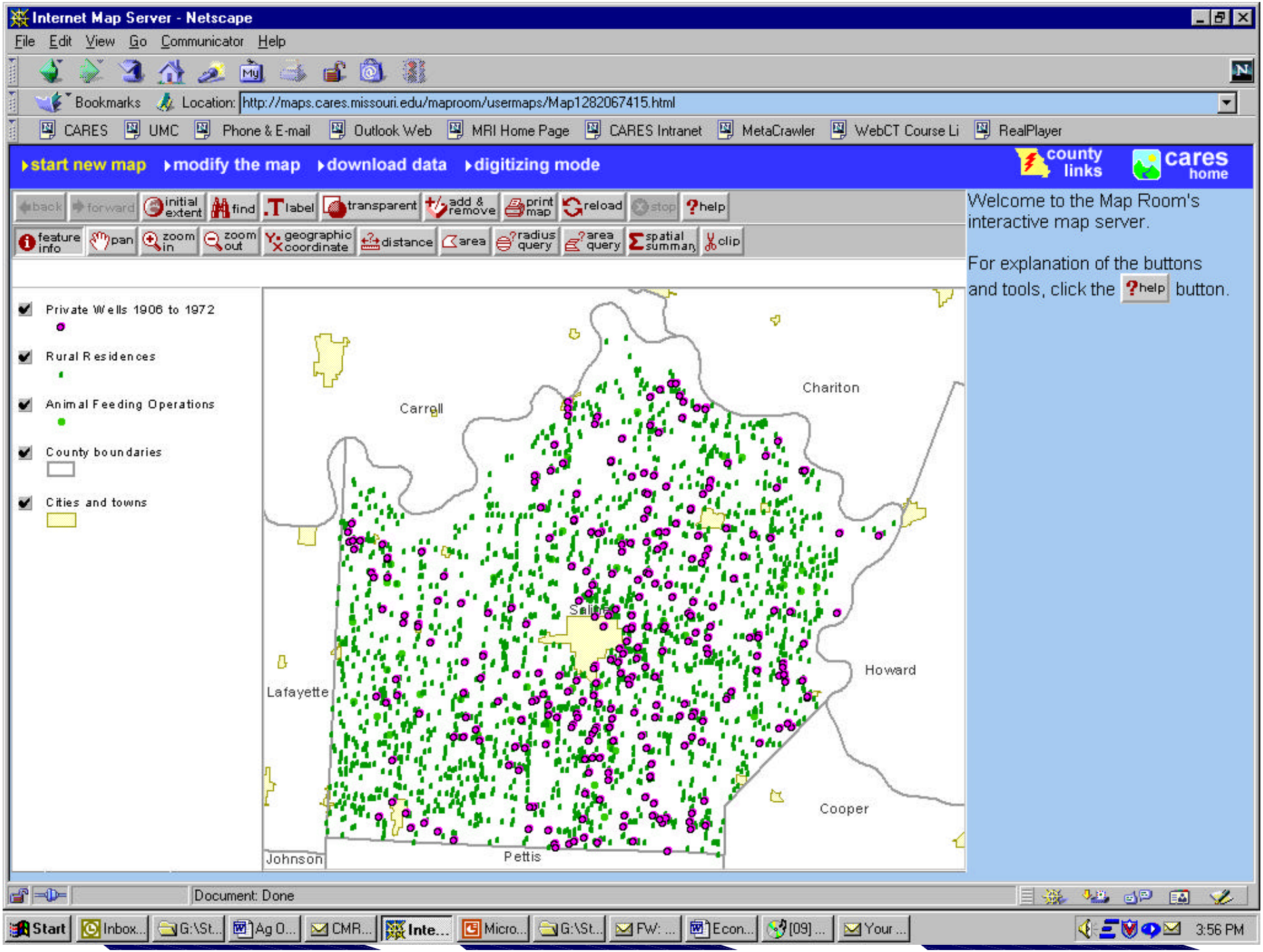
Income by Households

- [ ] Household Income Distribution
- [ ] Average Household Income
- [ ] Median Household Income
- [ ] Under $10,000
- [ ] $10,000-$15,000
- [ ] $15,000-$25,000
- [ ] $25,000-$35,000
- [ ] $35,000-$50,000
- [ ] $50,000-$75,000
- [ ] $75,000-$100,000
- [ ] Over $100,000

Document: Done


Livestock DSS - Netscape
File Edit View Go Communicator Help
Bookmarks Location: http://saline.missouri.edu/criteria-abs.html
CARES UMC Phone & E-mail Outlook Web MRI Home Page CARES Intranet MetaCrawler WebCT Course Li RealPlayer
Relative Suitability
Thematic Mapping
Livestock Site Selection
Absolute Suitability
Define criteria below for suitable livestock site selection. A maximum value of '0' is interpreted; as no maximum value specified for the criterion.
Criteria
Soil Drainage Class
Excessively drained
Somewhat excessively drained
Well drained
Somewhat moderately well drained
Somewhat poorly drained
Poorly drained
Very poorly drained
Criteria
Soil Permeability (inch/hr)
Less than 0.06
0.06 - 0.2
0.2 - 0.6
0.6 - 2.0
2.0 - 6.0
6.0 - 20.0
More than 20.0
Land Slope
Min slope: 0 %
Max slope: 0 %
Slope Aspect
Min aspect: 0 degrees
Max aspect: 0 degrees
Stream Proximity
Min distance: 0 feet
Max distance: 0 feet
Road Proximity
Min distance: 0 feet
Max distance: 0 feet
Minimum Area Requirement: 0 acres


Interactive Map Server - Netscape
File Edit View Go Communicator Help
Bookmarks Location: http://maps.cares.missouri.edu/maproom/ims.html
CARES UMC Phone & E-mail Outlook Web MRI Home Page CARES Intranet MetaCrawler WebCT Course Li RealPlayer
about us map room projects search
Interactive Maps of Missouri
Select your area of interest and data layers to make a map.
Step 1. Specify Area of Interest
Step 2. Select Data Layers
Step 3. Verify Selections
Help
All data layers are listed within the following categories. Click the category links for more data:
Administrative
Agricultural
Base Map
Cultural
Drinking Water
Facility
Floodplain
Geology
Health
Housing
Hydrography
Imagery
Income
Land Cover
Political
Population
Soil
Topography
Transportation
Water Quality
Watershed
Wetland
Saline Co
Saline County
Groundwater quality distribution
1:62000 Geology
Private Wells 1906 to 1972
Rural Residences
1:24000 Roads and Streets
Hyperlinked Photos
Cultural Sites
Santa Fe Trail
Natural Sites
Animal Feeding Operations
MDNR CAFOs more info..
Class I CAFOs
Animal Feeding Operations more info..
Land Available (for nutrient application)
Nitrogen Application (Lagoon/Surface Applied)
Phosphorus Application (Lag/Surface Applied)
Nitrogen Application (Pit/Injection Applied)
Phosphorus Application (Pit/Surface Applied)
Project Website: saline.missouri.edu
Click more info.. for more information about each layer.
indicates a partial coverage.
Center for Agricultural, Resource and Environmental Systems


Internet Map Server - Netscape
File Edit View Go Communicator Help
Bookmarks Location: http://maps.cares.missouri.edu/maproom/usermaps/Map1282067415.html
CARES UMC Phone & E-mail Outlook Web MRI Home Page CARES Intranet MetaCrawler WebCT Course Li RealPlayer
start new map
modify the map
download data
digitizing mode
county links
cares home
back forward initial extent find label transparent add & remove print map reload stop help
feature info pan zoom in zoom out geographic coordinate distance area radius query area query spatial summary clip
Private Wells 1906 to 1972
Rural Residences
Animal Feeding Operations
County boundaries
Cities and towns
Carroll
Chariton
Howard
Cooper
Lafayette
Johnson
Pettis
Welcome to the Map Room's interactive map server.
For explanation of the buttons and tools, click the help button.
Document: Done
Start
3:56 PM

Future Prospects

- Advancements in production and information management technologies are increasing our capacity to reduce water pollution.
- The challenge is to use these technologies and advancements in scientific knowledge to reduce adverse impacts of food and fiber production on water quality, people and the sensitive ecosystems on which we depend.